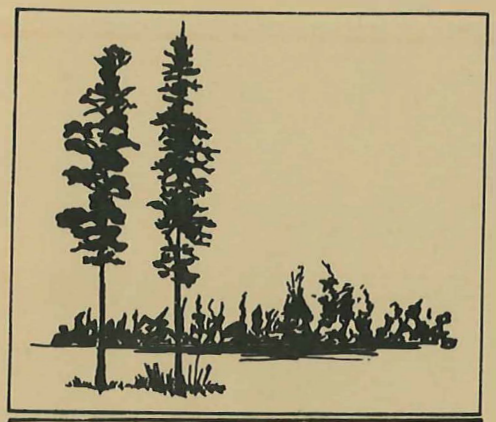

FOREST PEST CONDITIONS IN WISCONSIN

ANNUAL REPORT 1988

DEPARTMENT OF NATURAL RESOURCES
BOX 7921
MADISON, WISCONSIN 53707

FOREST PEST CONDITIONS IN WISCONSIN ANNUAL REPORT - 1988

Compiled and Edited by Allen J. Prey, David J. Hall, and Jane Cummings Carlson

DEPARTMENT OF NATURAL RESOURCES
Division of Resource Management
Bureau of Forestry

ACKNOWLEDGEMENTS

This record of the activities of forest pests and other destructive agents of growing trees in Wisconsin's forest nurseries, plantations, and natural timber areas was made possible by the dedicated work of pest management personnel in each district and at the Forest Pest Management Laboratory in Madison, DNR foresters, other Department field personnel, cooperators in other public agencies and private forest industry contributed valuable assistance in monitoring the forest lands in all classes of forest ownership.

There was a personnel change in the Forest Pest Management program in Wisconsin 1988. Steve Katovich who graduated in 1988 with a Ph.D. in Forest Entomology from the University of Minnesota replaced Frank S. Morse who retired after 37 years of service in 1987. Also, the station was moved from Black River Falls to the DNR District Headquarters in Eau Claire.

Preparation of this Annual Report was a result of a team effort involving Steve Katovich, William Kearby, Frank Morse, and Shane Weber, DNR District Entomologists who submitted district reports. Jane Cummings Carlson and Dave Hall, Forest Pest Unit, Madison, consolidated the district reports and wrote the final draft using personal computers. John Trobaugh, Forest Pest Unit Technician, and Sharon Nieland, Limited Term Employee, prepared the computer-generated and hand-drawn maps, and Katherine Severson, Southern District Program Services completed the word processing. Final printing was done by the DNR Bureau of Program Services.

Allen J. Prey
Supervisor, Forest Pest Management
June 19, 1989

TABLE OF CONTENTS

Forest Pest Management Personnel iv

INTRODUCTION 1

ASH 3
Ash Yellows 3

ASPEN 4
Aspen Bronzing 4
Aspen Blotchminer 4
Forest Tent Caterpillar 5
Early Fall Coloration and Premature Leaf Drop 5

BASSWOOD 6
Basswood Thrips 6

BALSAM FIR 7
Grasshoppers 7
Spruce Budworm 7
Balsam Gall Midge 7
Balsam Twig Aphid 7
Winter Injury 7

BIRCH 8
Birch Leafminer 8
Early Fall Coloration and Premature Leaf Drop 8
Yellow Birch Dieback 8

BUTTERNUT 9
Butternut Canker 9

CHESTNUT 10
Chestnut Blight 10

CHRISTMAS TREES 11
Cyclaneusma Needlecast 11
Drought 11
White Pine Blister Rust 12
Pine Gall Rust 12

CHERRY 12
Eastern Tent Caterpillar 12

LARCH 13
Larch Needlecast 13
Larch Sawfly 14

MAPLE 15
Bruce Spanworm 15
Maple Petiole Borer 15
Sugar Maple Decline Surveys 15
Sugar Maple Mortality 15
Early Fall Coloration and Premature Leaf Drop 16

NURSERY 16
Larch Needlecast 16
White Pine Seedling Root Rot 16

OAK 17
Oak Wilt 17
Fall Cankerworm 19
Walkingstick 19
Post Oak Locust 19
Twolined Chestnut Borer 19

PINE 20

Drought 20
Physiological Red Pine Needle Droop 20
Diplodia Canker and Shoot Blight 21
Scleroderris Canker 21
Red Pine Shoot Blight 22
Red Pine Pocket Mortality 22
Jack Pine Budworm 23
Pine Tussock Moth 23
European Pine Sawfly 23
Redheaded Pine Sawfly 23
Red Pine Needle Midge 23
Red Pine Shoot Moth 23
Eastern Pine Shoot Borer 23
Saratoga Spittlebug 23
Pine Root Collar Weevil 24
Pine Root Tip Weevil 24
White Pine Weevil 24
Pine Engraver 24
Red Turpentine Beetle 25
White Grubs 25
Plains Pocket Gopher 25
Pine Gall Weevil 25

SPRUCE 25
Yellowheaded Spruce Sawfly 25

RED PINE SEED AND CONE INSECTS 25

BLACK WALNUT 26
Walnut Dieback and Canker 26
Plantation Black Walnut Canker 26

MISCELLANEOUS SPECIES 27
Gypsy Moth 27
Hickory Bark Beetle 28

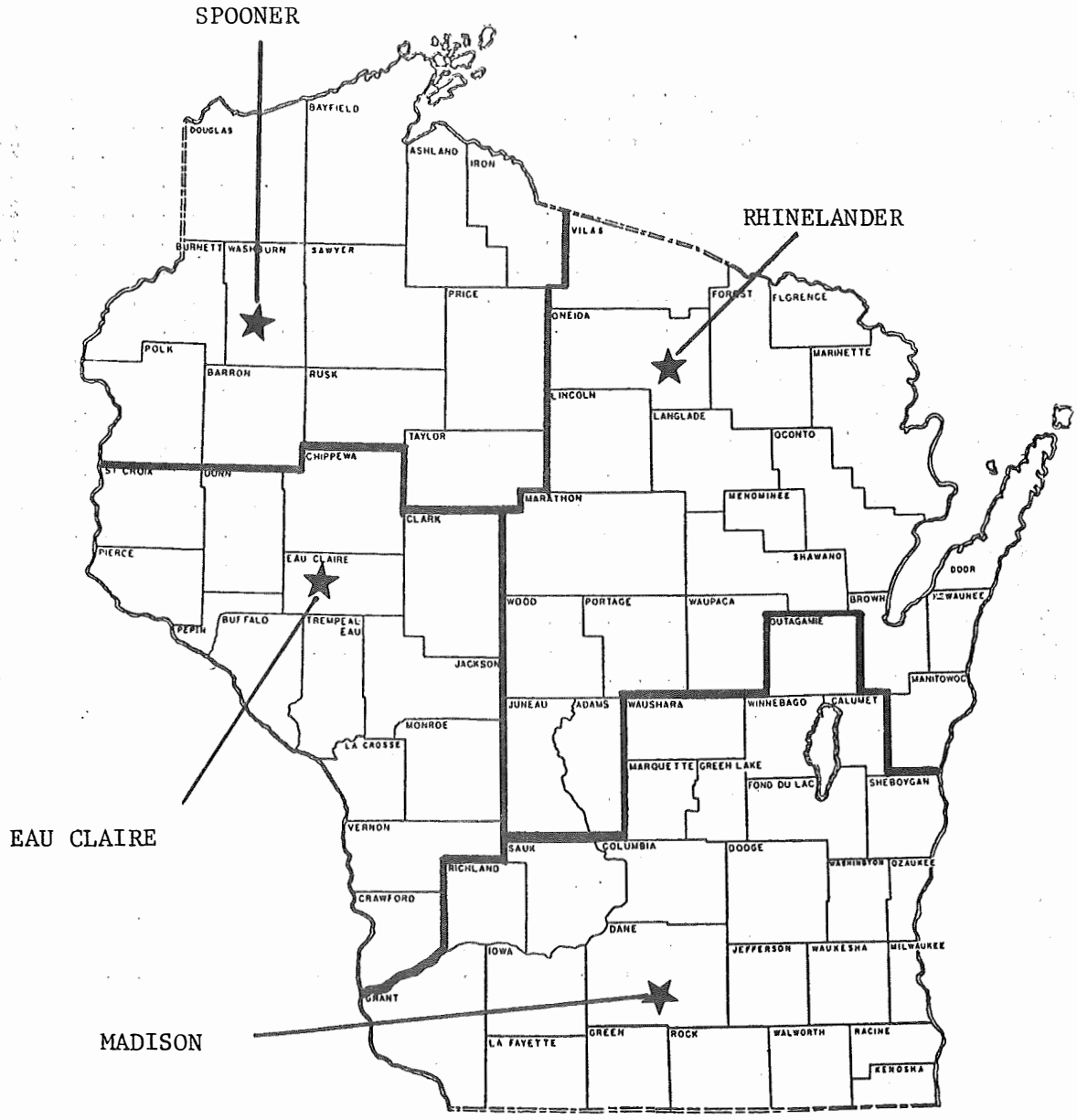

Figure 1. Station locations of Wisconsin Department of Natural Resources District Entomologists and Forest Pest Unit Personnel.

DEPARTMENT OF NATURAL RESOURCES
Forest Pest Management Personnel - December 31, 1988

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INTRODUCTION

This report lists the major insect and disease problems reported on forest land in Wisconsin in 1988. While this report does not list all the insect and disease problems that occurred on forest land, it does highlight major or note-worthy insect infestations, and disease occurrences including abiotic damage to trees.

In 1988, insect and disease detection surveys were conducted on 12.5 million acres and evaluation surveys on another 4.4 million acres. In addition, DNR District Entomologists and forest pest staff continued to teach integrated pest management principles to DNR foresters, industrial foresters and private woodland owners. Approximately 1,629 individuals were trained at 44 sessions in 1988. Also in 1988, an integrated pest management manual titled, "WISCONSIN WOODLANDS: Identifying and Managing Pine Pests in Wisconsin, 1988, by H. A. Goulding, D. J. Hall, K. F. Raffa, and A. J. Martin, G3428, University of Wisconsin-Extension was published. The purpose of this manual was to provide the woodland owner with pest management guidelines and information for diagnosing common pests of pines native to Wisconsin (jack pine, red pine, and white pine). The manual stressed integrated pest management (IPM) in which all available techniques were consolidated into a unified program so that pest populations could be managed with minimum economic damage or environmental impact.

The Forest Pest Unit had a display of current forest insect and disease literature and posters of important forest pests at the DNR statewide forestry functional meeting in Appleton, Wisconsin in January 1988. Also, results of a maple sugar bush dieback and decline survey in Wisconsin in 1987 were presented at University of Wisconsin-Extension Sugar Maple Institutes held at Luxemburg, Wisconsin, the River Edge Nature Center, Newburg and at Richland Center in January. Also, a poster titled, "Investigations of Sugar Maple Decline in Wisconsin Sugar Bushes," was presented at the Acid Deposition and Forest Decline International Symposium at Rochester, New York in October.

There was nationwide press and television publicity of an attempt to control chestnut blight near West Salem, Wisconsin by applying protein-based foam to four known infected trees, then cutting and burying the trees. Press and television media from Milwaukee, LaCrosse, St. Paul, and the Pasadena Times Press were in attendance. Also, the National Geographic Society sent a photographer and writer to cover the Wisconsin control project which will be included in a future article on chestnut blight.

A four-minute video titled, "Tent Caterpillars on the Menominee," showing the forest tent caterpillar aerial control project with Bacillus thuringiensis was produced by the Wisconsin Department of Natural Resources and sent to television stations in northeastern and north-central Wisconsin.

Information on black walnut canker and dieback was presented at the National Walnut Council meeting and field tour at Mount Horeb, Wisconsin in July.

The DNR Forest Pest Advisory and Steering Council flew to Menominee, Michigan and met with Michigan DNR and Department of Agriculture Pest Staff. They toured Gypsy moth and

oak wilt sites in Marinette County, Wisconsin. They discussed the approaches to controlling both pests along the Wisconsin-Michigan border, including the possibility of joining a Pest Compact.

The Forest Pathologist gave a presentation on "How to Identify Diseased and Defective Trees" to 100 participants at the Wisconsin Parks and Recreation Association's annual meeting in Wausau in March. She also gave a training session to Marathon County Parks tree trimming crews on "How to Identify Diseased and Defective Trees."

A slide series and lecture titled, "Your Friends, the Insects," was presented at the Wisconsin State Fair in August, and at the elementary school in Oregon, Wisconsin in October.

The Forest Pest Technician organized a "Reforestation Workshop" that was held for foresters at Boscobel, Wisconsin in September. The workshop addressed reforestation problems and concerns in southern Wisconsin and was based on a statewide reforestation survey conducted by the Forest Pest Unit technician.

DNR District Entomologists also served as DNR District Pesticide Coordinators advising all employees within the District on proper and safe use of pesticides. They also inspected Department pesticide storage facilities and insured that Department employees were properly trained and certified in pesticide use.

The Forest Pest staff and District Entomologists also spent a good percentage of their time on herbicides and forest weed control. They planned a herbicide training session for DNR and industrial foresters to be held in February 1989. They met with Forest Pest Specialists from Minnesota, Michigan, and U.S. Forest Service to enter data for "Lake States Herbicide Tables." The staff entomologist wrote a review of Velpar use on forest land in reply to a request from the Natural Resources Board. He also presented herbicide information to a DNR Southern District foresters' training session held in Madison.

District Entomologists and Forest Pest staff also provided technical information on tick biology and identification in relation to Lyme Disease at several workshops throughout the state.

The Forest Pest staff participated various national and regional meetings and conferences in 1988, such as the National Phytopathological Society meeting in San Diego, California, and the National Society of American Foresters meeting in Rochester, New York. They also participated in the North Central Forest Pest Workshop in Gaylord, Michigan in September and the North-central Weed Control Conference in Minneapolis in December.

The Forest Pest staff and District Entomologists participated in U.S. Forest Service - State Cooperators meeting in St. Paul in March. A variety of topics were covered including aerial photography, the Geographical Information System used in Minnesota, Lyme Disease, and Artificial Intelligence.

ANNUAL REPORT - 1988

ASH

Ash Yellows - Mycoplasma Like Organism (MLO)

No new locations of ash yellows were confirmed in 1988. However, two locations were identified and confirmed with the DAPI (4,6-diamidino-2-phenylindole) staining technique by Russell Spear and Dr. Gayle Worf, Department of Plant Pathology, University of Wisconsin-Madison (Figure 2).

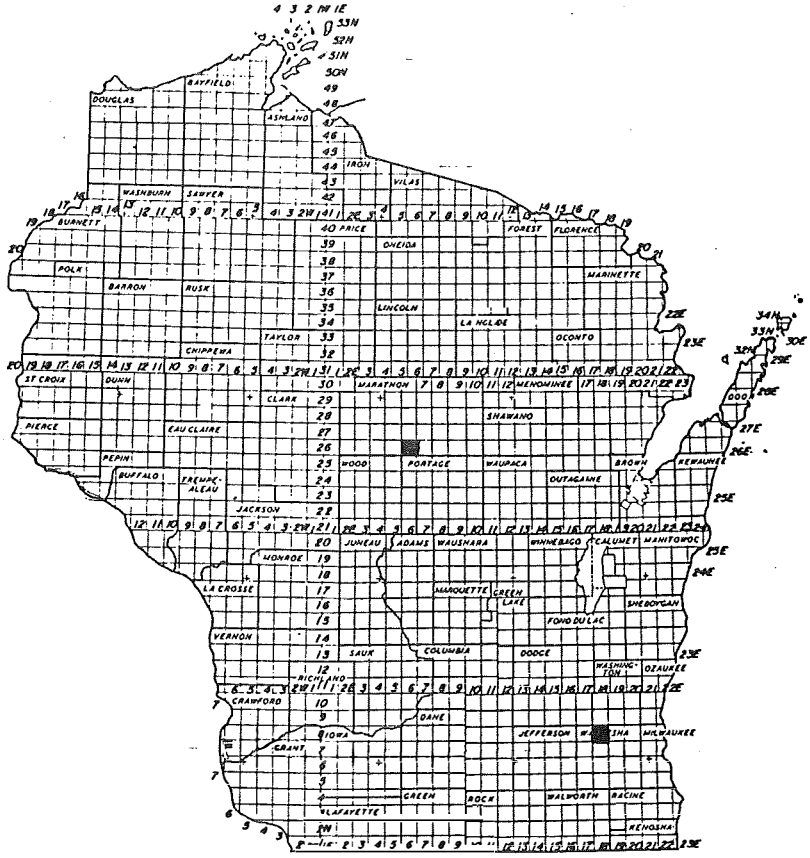


Figure 2. Known township locations of Ash Yellows in Wisconsin-1988.

ASPEN

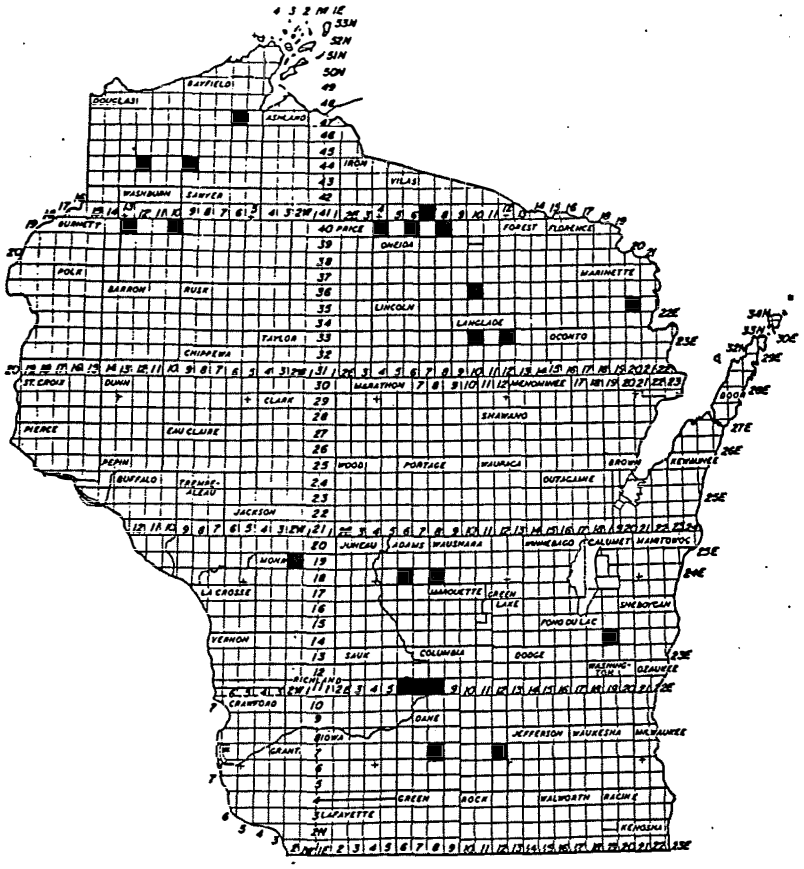


Figure 3. Known township locations of Aspen Bronzing - 1988.

Aspen Bronzing - Unknown

No new locations of aspen bronzing were observed in 1988 (Figure 3). Incidence of bronzing symptoms decreased from 1987 in Barnes Township (T44N, R9W) Bayfield County, east and west of State Highway 27. A single big-tooth aspen showed bronzing symptoms in northeastern Washburn County, Bass Lake Township.

Symptoms were observed in Sauk County, central Wisconsin, in mid-July on big-tooth aspen and on an unidentified *Populus* sp. This is a location where symptoms have occurred annually since the early 1970's. Samples were collected from affected trees and sent to Dr. Sandy McNabb, Iowa State University, Ames, Iowa. The samples were examined for the presence of fastidious xylem-inhabiting bacteria. Results will be summarized in a future report by Dr. McNabb.

Aspen Blotchminer - *Phyllonorycter tremuloidiella* (Braun)

The populations that erupted to high levels across northern Wisconsin in 1987 collapsed in the northwestern counties but continued to cause scattered heavy leaf damage in Oneida and Vilas counties.

Forest Tent Caterpillar - *Malacosoma disstria* (Hubner)

The outbreak which occupied several north-eastern counties in 1987 now also covers several northwestern counties (Figure 4). Caterpillars caused wide-spread light to heavy defolia-tion of aspen, oak and white birch.

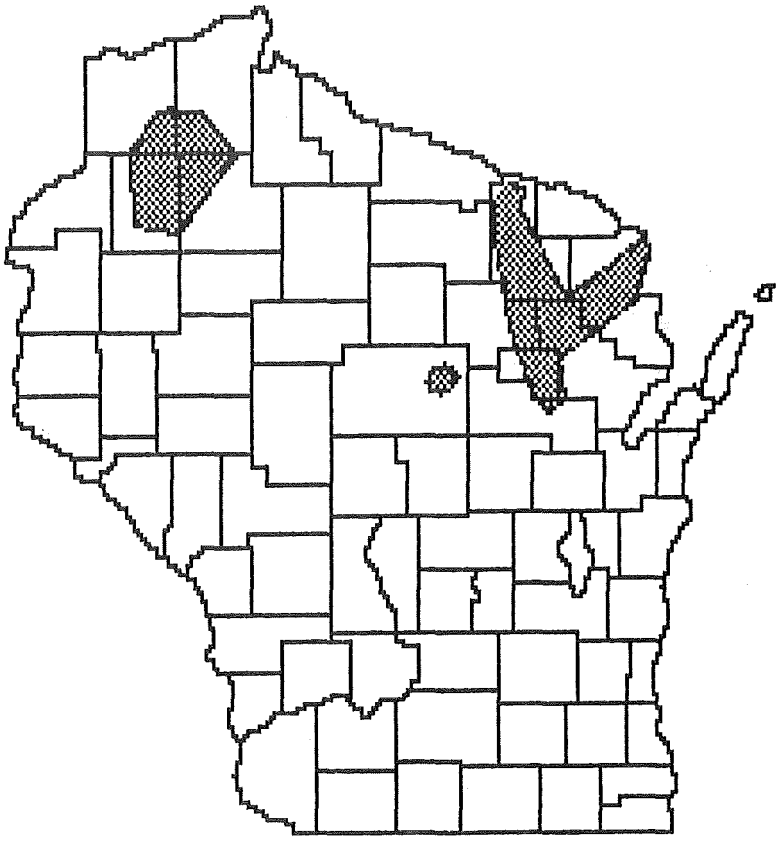


Figure 4. Area of defoliation by the Forest Tent Caterpillar - 1988.

About 16,000 acres of high quality red oak on the Menominee Indian Reserva-tion were sprayed with Dipel (*Bacillus thuringiensis*) at six BIU/acre. Larval numbers were so heavy in some areas that they defoliated the oaks before the B.t. was applied causing poor deposition and control.

A fall egg mass survey on the Menominee reservation predicts very heavy larval numbers in 1989. An egg mass survey on 2700 acres of aspen, oak and other northern hardwoods in western Marinette County predicts high larval numbers.

Early Fall Coloration and Premature Leaf Drop - Drought

Aspen in Chippewa and northern Clark counties exhibited premature leaf drop in early August due to drought stress. Rain in August caused many of these trees to refoliate.

Aspen leaves turned yellow and dropped in late July in west-central Washburn County. No refoliation occurred. Premature leaf drop was light and scattered throughout Washburn, Burnett, Polk and Barron counties, northwestern Wisconsin.

BASSWOOD

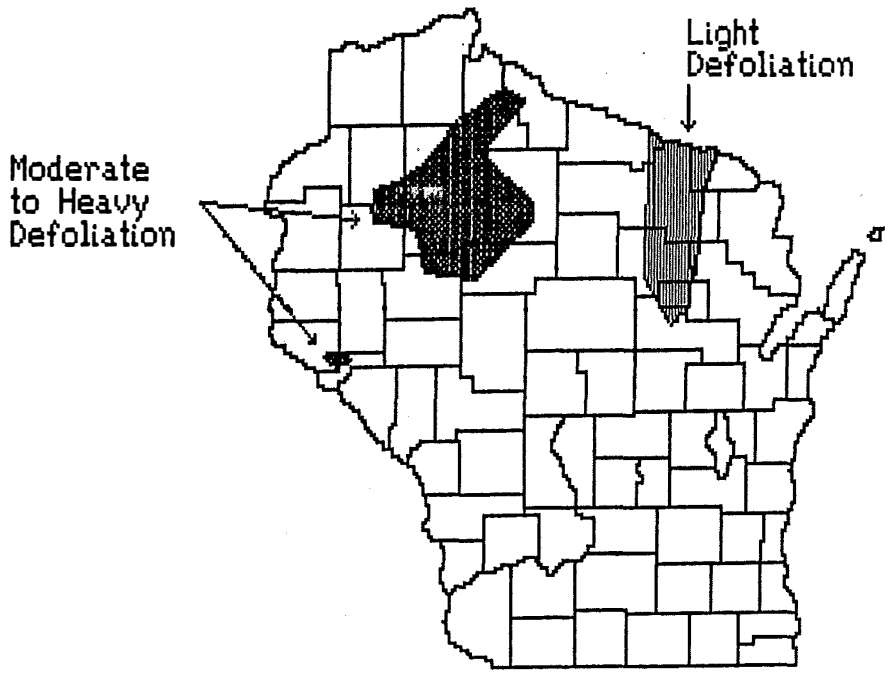


Figure 5. Area of defoliation in northern Wisconsin caused by Basswood Thrips - 1988.

Basswood Thrips - *Thrips calcaratus* Uzel

Defoliation decreased to light levels in northeastern Wisconsin but the area infested remained the same (Figure 5). Defoliation remained very heavy in northwestern Wisconsin. Heavy defoliation was evident in northern Chippewa County and in parts of Pepin and Pierce counties. Scattered, very light defoliation occurred on many north-facing slopes in southwestern Wisconsin.

A cooperative study between University of Wisconsin, Department of Entomology and DNR forest pest management unit was initiated in the spring of 1988 to determine the impact of thrips defoliation on tree growth. Plots were established in Iowa, Grant, Washburn, Rusk, Menominee, Forest, and Langlade counties.

BALSAM FIR

Grasshoppers - *Melanopus* sp.

An eighty acre plantation of balsam fir, white spruce, and Scotch pine in Marinette County was attacked by heavy numbers of grasshoppers which were eating the needles and wounding the tender new shoots in early July. The plantation was sprayed with carbaryl.

Spruce Budworm - *Choristoneura fumiferana* (Clemens)

No significant defoliation was observed anywhere in Wisconsin. Egg mass surveys in the northwestern counties indicate very low populations for 1989.

Balsam Gall Midge - *Paradiplosis tumifex* (Gagne)

The population in Washburn County collapsed. No significant damage was reported anywhere in Wisconsin.

Balsam Twig Aphid - *Mindarus abietinus* (Koch)

Damage was noticeable in a number of balsam fir Christmas tree plantings in LaCrosse and Jackson counties. Insecticidal treatments were applied in several cases. Aphid populations dropped sharply after early June though damage persisted through the summer.

Winter Injury

Winter injury was prevalent in Polk, Barron and Burnett counties. Many balsam fir planted as Christmas trees in 1985, 1986, and 1987 died during the 1987-88 winter.

BIRCH

Birch Leafminer - *Fenusa pusilla* (Lepeletier)

Widespread light to heavy leafmining of white birch took place in northwestern and west-central Wisconsin plus Oneida and Vilas counties in northeastern Wisconsin. Open grown, edge and ornamental trees were attacked. Interior forest trees were attacked very little.

Early Fall Coloration and Premature Leaf Drop - Drought

Leaf drop in late July in Washburn, Burnett, Polk and Barron counties in northwestern Wisconsin was common on yellow birch. Refoliation did not occur. Many white birch dropped their leaves in early to mid-August due to drought stress in Chippewa and Clark counties.

Yellow Birch Dieback - Unknown

Yellow birch continues to show symptoms of dieback in Florence and Menominee counties, north-central Wisconsin. Affected trees have thin crowns and twig and branch dieback. Mortality of yellow birch is scattered throughout the properties. Dieback in Rusk County continued at approximately the same incidence as in 1987. Yellow birch has not been a significant component of hardwood stands in northwestern Rusk County and has now been virutally eliminated due to dieback and mortality. A team of forest managers, a silviculturalist, and a forest entomologist developed recommendations for harvesting declining yellow birch. They are as follows:

Crown Condition	Recommendation
Less than 25% live crown	Harvest as soon as possible
More than 25% live crown with smooth bark (young vigorous trees)	Carry one log trees to 16" dbh then harvest Carry two log trees to 18" dbh then harvest
Any crown condition on rough bark (old and poor vigor) trees	Harvest as soon as possible to avoid any further loss in value

Note: Management objectives and residual basal area may be a reason to modify these recommendations.

BUTTERNUT

Butternut Canker - *Sirrococcus clavigignenti - juglandacearum* Nair, Kostichka and Kuntz

New locations of butternut canker were observed in Chippewa County, west-central Wisconsin, and Door County, east-central Wisconsin (Figure 6). Three mature butternut trees in northern Chippewa County were found dead and heavily cankered. Butternut scattered within a maple syrup producing sugar bush was found infected in Door County (Sections 30,31, T30N, R27E).

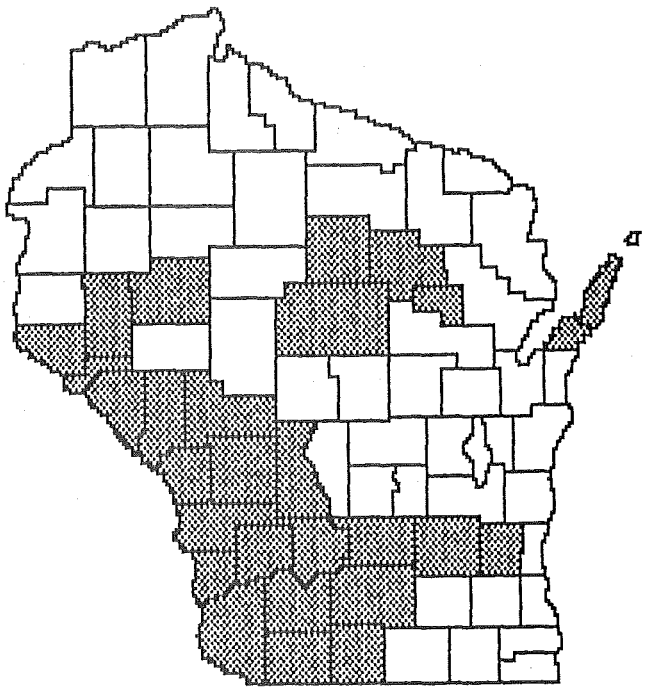
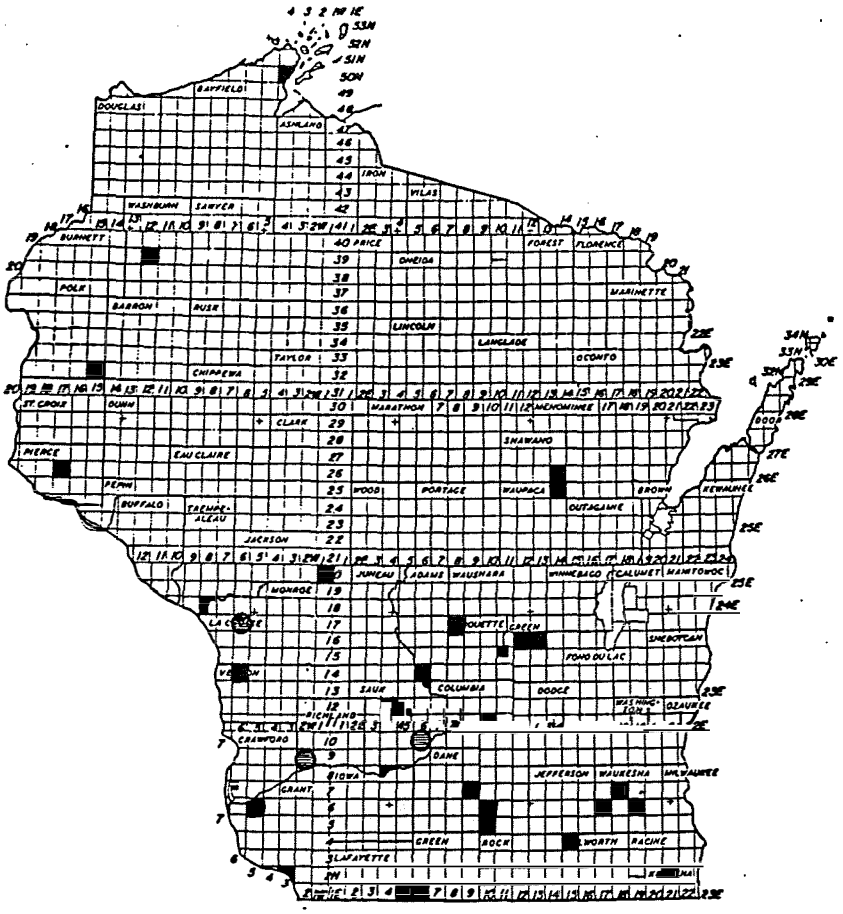


Figure 6. Known county distribution of Butternut Canker - 1988.

CHESTNUT



Chestnut Locations = ■ Chestnut Blight Locations = ⊜

Figure 7. Township locations of Chestnut and Chestnut Blight - 1988.

Chestnut Blight - *Endothia parasitica* (Murrill) Anderson and Anderson

Chestnut blight was first reported in Wisconsin in 1986 in Richland and Sauk counties, southwestern Wisconsin. In 1987, chestnut blight was detected in LaCrosse County (Figure 7). Eradication was attempted in 1987 in LaCrosse County after stroma were observed on four trees. A foam, normally used to control forest fires, was sprayed on the infected trees in May, 1987, to inhibit spore dispersal during felling. The foamed, infected trees were placed in a trench and covered with topsoil. In 1988, this procedure was repeated in May, when stroma were again observed on four trees within 100 feet of the previously infected trees. Extra precautions taken in 1988 included: covering stumps of infected trees with topsoil to prevent sprouting, resurveying after eradication, washing the bulldozer with water and disinfecting the shoes of all workers with ethyl alcohol.

In a fall survey, two more infected trees were observed at the LaCrosse County site. Both trees had stroma on their root collars. A mixture of manure and soil from the site was mounded up around the bases of the infected trees and covered with plastic. This soil and manure mixture was placed on the trees to slow or stop canker progression.

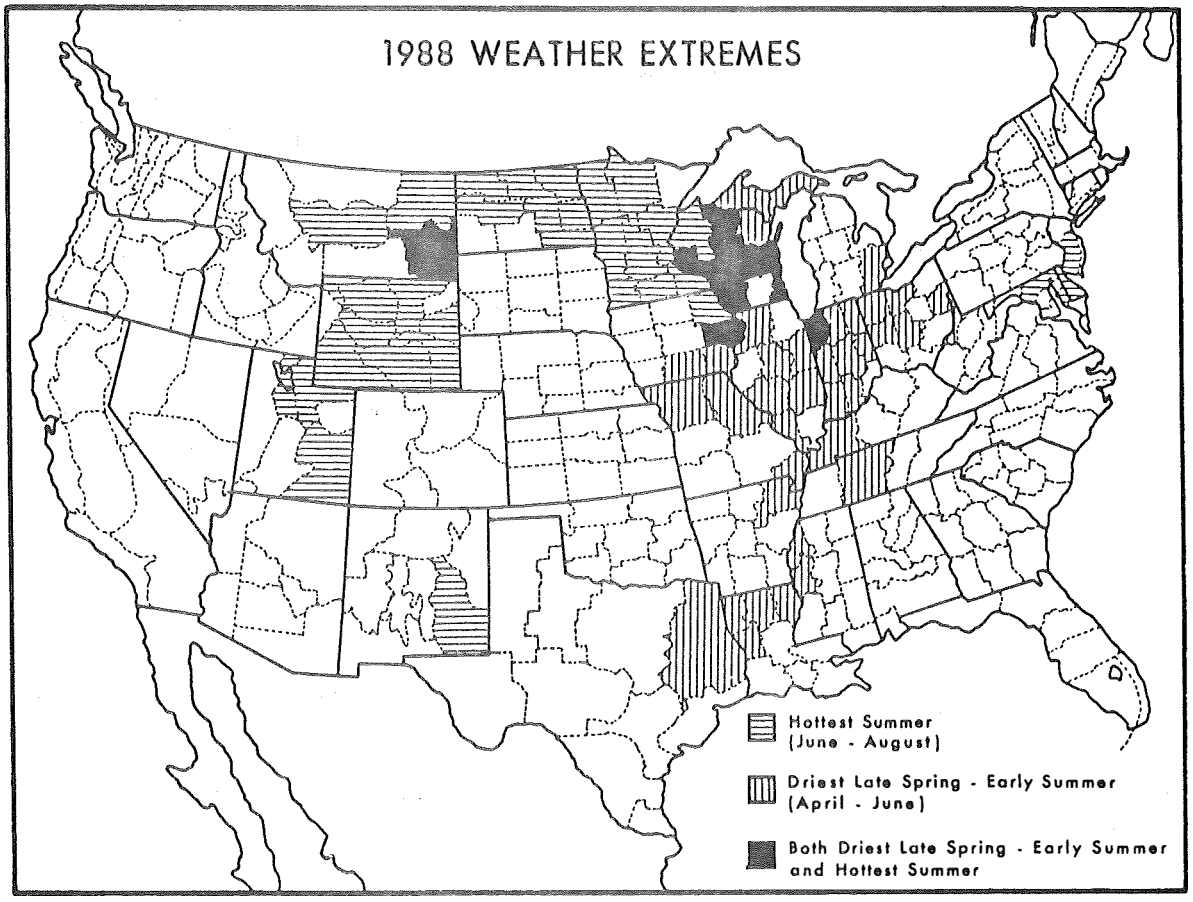
CHRISTMAS TREES

Cyclaneusma Needlecast - *Cyclaneusma minus* (Butin) DiCosmo, Peredo and Minter

In March, Christmas tree growers in south-central Wisconsin and central Wisconsin reported symptoms of Cyclaneusma needlecast on Scotch pine. Symptoms were prevalent from 1986 infections.

Drought

The extreme drought (Figure 8) of 1988 caused mortality of many new plantings and one-year-old plantings of balsam fir, fraser fir, white pine and Scotch pine statewide. Older balsam fir, white pine and Scotch pine were also killed on sandy soils in western and central Wisconsin.


1988 WEATHER EXTREMES
Hottest Summer (June - August)
Driest Late Spring - Early Summer (April - June)
Both Driest Late Spring - Early Summer and Hottest Summer

Map courtesy of the National Climatic Data Center.

Figure 8. Weather extremes recorded by the National Climatic Data Center.

White Pine Blister Rust - *Cronartium ribicola* Fisch.

Branch flagging was common but not overly abundant in LaCrosse, Jackson and Monroe counties.

Pine Gall Rust - *Cronartium quercuum* (Berk.) Miyabe ex Shirai f. sp. *banksianae* Burdsall & Snow or *Endocronartium harknessii* (J. P. Moore) Y. Hiratsuka.

Galls were collected from Scotch pine in Waushara County in early June and their spores were analyzed for identification of the rust species (eastern gall rust or western gall rust). All galls were caused by eastern gall rust *Cronartium quercuum* f. sp. *banksianae*.

CHERRY

Eastern Tent Caterpillar - *Malacosoma americanum* (Fabricius)

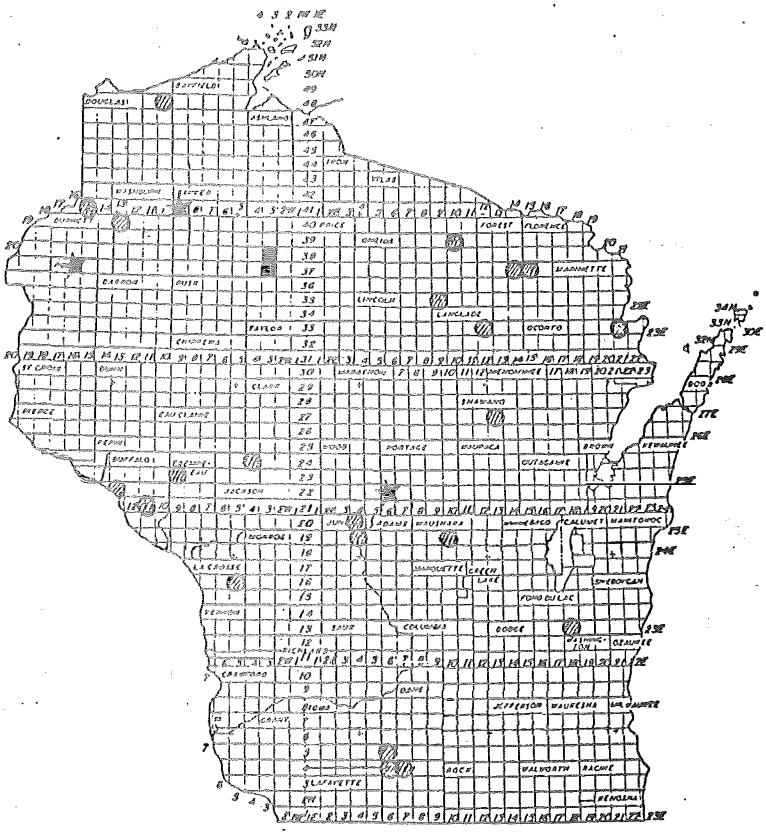
The numbers of tents and the defoliation of roadside black cherries continued at extremely high levels state wide. The population had a more northern distribution than in past years.

The highest numbers of tents ever seen were reported in many locations state wide. Despite the combination of severe defoliation and drought, the only mortality of black cherry was reported in Jackson, Trempealeau and Eau Claire counties.

LARCH

Larch Needlecast - *Mycosphaerella laricina* (Hartig) Neg.

Defoliation was at trace levels on European larch on the Coulee Experimental Forest in LaCrosse County. Heavy defoliation usually occurs on the Coulee and infection was probably low because of the drought. This pattern was evident statewide as several previously infected stands had trace to no defoliation evident.



European larch survey locations = ●
M. laricis present 1987 = ★
M. laricis present 1988 = ■

Figure 9. Township locations of European larch surveyed in 1988.

Larch Needlecast - *Meria laricis* Vuill.

Meria laricis was first observed in Wisconsin in 1987 at the Hayward state forest tree nursery on 2-0 European larch. A survey was conducted in 1988 to determine the state wide distribution of *M. laricis* needlecast on European larch. Thirty-four samples from plantations and single trees were examined for the presence of the needlecast fungus. *M. laricis* was identified on three samples, all from the Flambeau River State Forest in northwestern Wisconsin (Figure 9). The plantations where *M. laricis* is present are seven, four, and three years old. These infected plantations will be surveyed in 1989 to determine the severity of needlecast, frost damage and insect defoliation.

In an attempt to determine the origin of *M. laricis* in Wisconsin, three European larch seed lots used at the Hayward Nursery were analyzed for the presence of the fungus. The project was a cooperative effort between Wisconsin Department of Natural Resources, University of Minnesota, Southeastern Forest Experiment Station at Olustee, Florida, and the Iowa State University Seed Laboratory. Four isolation techniques (Table 1) were used to determine if the European larch seed lots were infested with *M. laricis*. No *M. laricis* was isolated from any of the seed lots. Organisms isolated are listed in Table 2.

Table 1. Sampling techniques used by cooperators to isolate ***Meria laricis*** from European larch seed.

COOPERATOR	TREATMENTS			
	Control[1]	Running[2] Tap Water	Surface Sterilize[3] and Plate	Surface Sterilize[4] Macerate and Plate
Wisconsin DNR	X			
University of Minnesota Plant Disease Clinic	X	X	X	X
Southeastern Forest Exp. Station		X	X	
Iowa State Univesity Seed Lab		X		

1 Seed plated onto PDA without treatment.
2 Seed rinsed in running tapwater for 24 hours, then aseptically plated.
3 **University of Minnesota** - Seed surface sterilized in 10 percent sodium hypochlorite for ten minutes, then rinsed three times with sterile water, and aseptically plated. **Southeastern Forest Experimental Station** - Seed surface sterilized in 70 percent ethyl alcohol for 15 seconds followed by 20 percent sodium hypochlorite for two minutes, then plated.
4 Seed surface sterilized in 10 percent sodium hypochlorite for ten minutes, macerated with a mortar and pestle, then aseptically plated.

****

Table 2. Organisms isolated from European larch seedlots XLD-5-84, XLD-2-86, and XLD-5-87.

Alternaria sp.	***Phomopsis*** sp.
Aspergillus flavus	***Phylactinia*** sp.
A. niger	
A. terreus	***Rhizopus*** sp.
Chaetomium sp.	***Scopulariopsis*** sp.
Fusarium sp.	***Trichoderma*** sp.
Helminthosporium sp.	***Trichothecium*** sp.
Mucor sp.	Unidentified bacteria and yeast
Penicillium sp.	
Phoma sp.	

Larch Sawfly - *Pristiphora erichsonii* (Hartig)

The locally heavy 1987 populations in the west-central and northwestern counties declined. No reports of defoliation were received from anywhere in Wisconsin.

MAPLE

Bruce Spanworm - *Operophtera bruceata* (Hulst)

The first recorded outbreak of this spring defoliator in Wisconsin began in 1984 on the Menominee Indian Reservation. It caused heavy defoliation in several northeastern counties in 1985 through 1987 and in three northwestern counties in 1986. The outbreak declined in 1987 in the northeastern counties and no defoliation was seen anywhere in Wisconsin in 1988.

Maple Petiole Borer - *Caulocampus acericaulis* (MacGillivray)

Reports of light to moderate leaf damage were received from scattered locations state wide.

Sugar Maple Decline Surveys

Three surveys to determine the incidence and severity of dieback and decline of sugar maple were conducted in 1988. The objectives of each survey were as follows:

Survey 1. Determine the incidence and severity and possible causes of sugar maple dieback and decline in Wisconsin sugarbushes. Determine if there is a correlation between habitat classification and maple health.

Survey 2. Determine if there is a difference in the number, volume, and basal area per acre of healthy, and dead and declining sugar maple and associated hardwoods between four rain pH zones across Wisconsin. The amount of decline and mortality associated with known insect and disease pests will also be determined.

Survey 3. Cooperate with the North American Sugar Maple Decline Project by setting up eighteen plots across northern Wisconsin to monitor dieback, decline, and the presence of insect and disease pests. This is a three year project which involves plots in sugar maple in Canada and throughout Northeastern North America.

Reports are being written for surveys 1 and 2. Survey 3 will continue in 1989 and 1990 and a report will follow.

Sugar Maple Mortality - Drought

Mortality of six- to nine-inch dbh sugar maple was scattered throughout eastern Menominee County where forest tent caterpillar defoliation occurred. The affected trees were weakened by defoliation by the forest tent caterpillar in 1987 and died in 1988 from drought stress and Armillaria root rot.

Early Fall Coloration and Premature Leaf Drop - Drought

Sugar maples in Chippewa and northern Clark counties, western Wisconsin, had abnormally early (mid-August) fall coloration and leaf drop. In northwestern Wisconsin, early leaf coloration and drop was scattered throughout Washburn, Burnett, Polk and Barron counties. Drought stress most likely triggered this response.

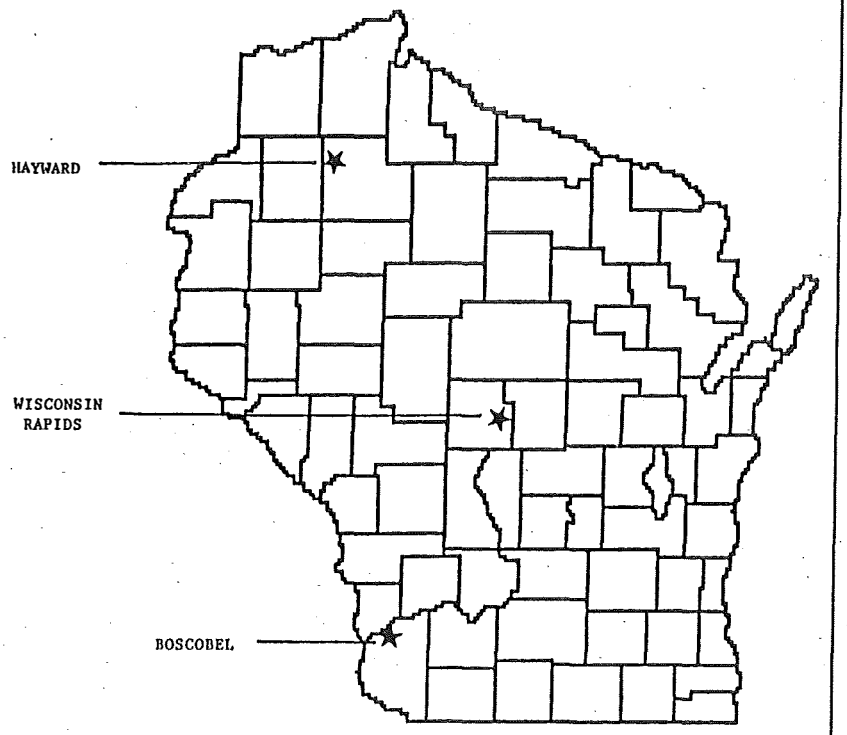


Figure 10. Locations of the Wisconsin state forest tree nurseries.

NURSERY

Larch Needlecast - *Mycosphaerella laricina* (Hartig) Neg. or *Meria laricis* Vuill.

No larch needlecasts were observed at the Hayward or Griffith state forest tree nurseries. No larch was grown at Wilson Nursery in 1988.

See Figure 10 for locations of the Wisconsin State Forest Tree Nurseries.

White Pine Seedling Root Rot - *Fusarium oxysporum* Schlecht.

Root rot of white pine seedlings has been occurring in the Wisconsin state forest tree nurseries for over ten years. In research conducted in 1987 and 1988, Scott Enebeck, a graduate student at the University of Minnesota, determined that white pine grown in the greenhouse and put under moisture stress could be infected by *Fusarium oxysporum* and manifest the symptoms of white pine root rot observed in the nursery. The uneven distribution and perhaps inadequate supply of water to the white pine seedlings at the Wilson Nursery in southern Wisconsin may be the critical factor that has induced a high incidence of root rot for so many years.

White pine root rot was at trace or undetectable levels at Griffith and Wilson Nurseries in 1988 except for within experimental plots at Wilson Nursery where the University of Minnesota in cooperation with the U.S. Forest Service, carried out research on damping-off and root rot control.

OAK

Oak Wilt - *Ceratocystis fagacearum* (Bretz) Hunt

No new counties reported oak wilt in 1988 (Figure 11). Oak wilt control efforts have been intensive in two counties, Marinette and Menominee. One new pocket was observed in Marinette (Figure 11) and two in Menominee. This was a significant drop in new infections compared to previous years. Two lined chestnut borer, drought, and Armillaria root rot affected many more trees than oak wilt in both these counties. Oak wilt was also prevalent on sandy sites in western St. Croix, Eau Claire, Jackson and eastern Monroe counties in western Wisconsin.

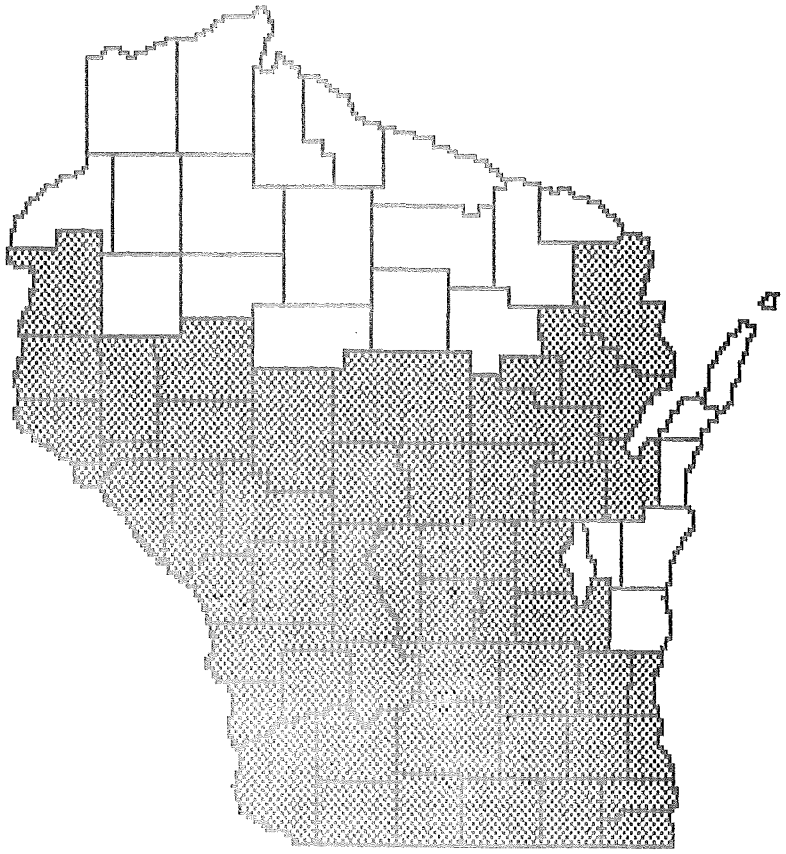


Figure 11. Known county distribution of Oak Wilt - 1988.

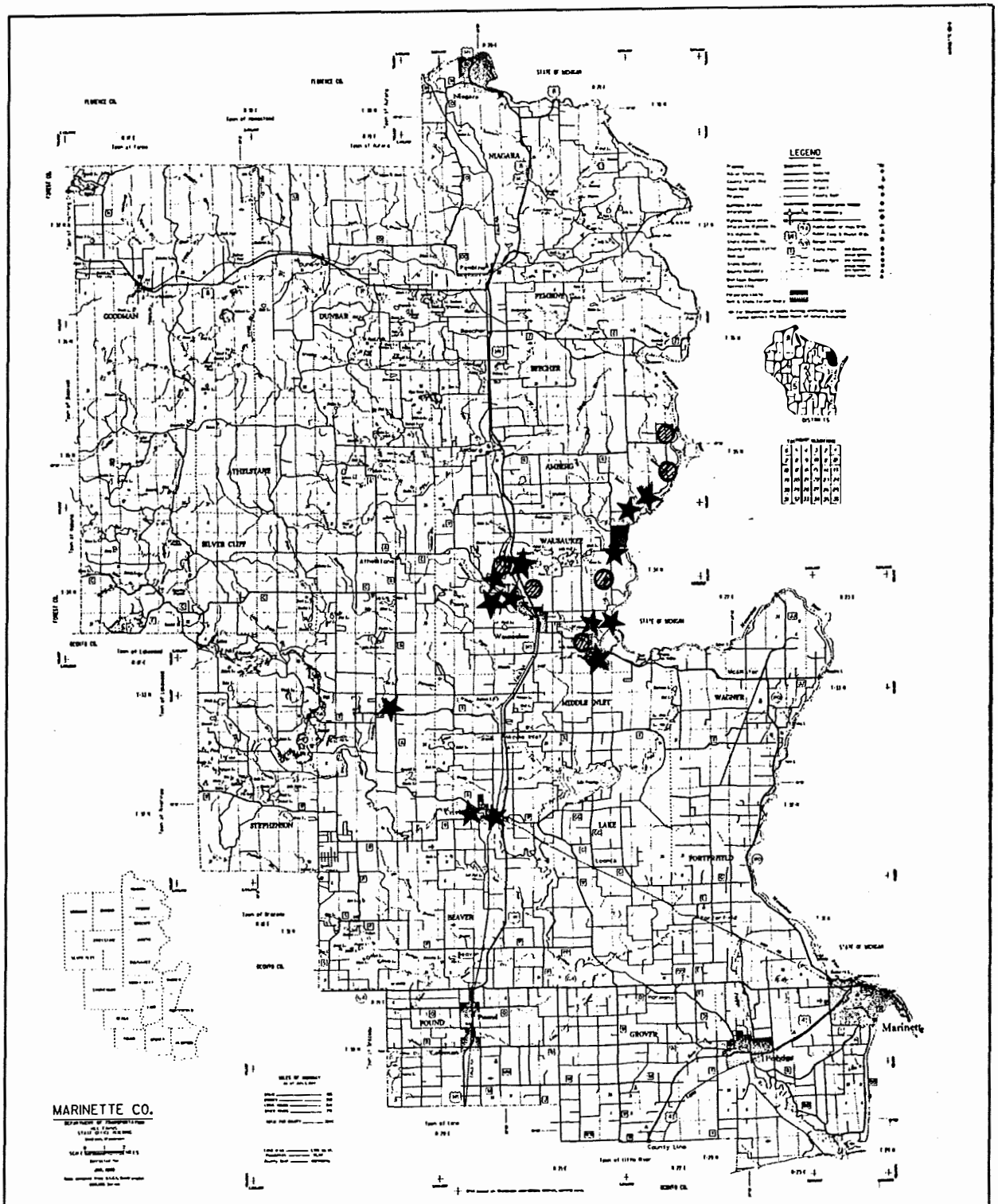


Figure 12. Locations of Oak Wilt pockets in Marinette County detected in 1988 (square), in 1987 (circle) and prior to 1987 (star).

Fall Cankerworm - *Alsophila pometaria* (Harris)

Defoliation increased in area and intensity in Jefferson, Sauk, Columbia, Adams and Marquette counties where many oak stands, especially on hilltops, were heavily to severely defoliated (Figure 13). Predacious ground beetles were numerous in many of these sites signaling the decline of many of these infestations.

Figure 13. Location of moderate to heavy defoliation by the fall cankerworm - 1988.

Walkingstick - *Diapheromera femorata* (Say)

Walkingsticks caused moderate to heavy defoliation to stands of northern pin oak in southeastern Douglas County.

Post Oak Locust - *Dendrotettix quercus* Packard

Noticeable defoliation of black and northern pin oak occurred in localized areas in eastern Eau Claire and Jackson counties.

Twolined Chestnut Borer - *Agrilus bilineatus* (Weber)

Oak mortality skyrocketed in many locations this year. Pockets of light to heavy mortality of red and white oak occurred in Sauk, Columbia, Adams and Marquette counties in stands that had been heavily defoliated by the fall cankerworm.

Pockets of mortality of northern pin oaks occurred on dry sights in Menominee and Shawano counties.

Tens of thousands of oaks were killed in the northwestern counties. Black oaks on coarse sandy soils in Polk and Burnett counties were hardest hit. Many bur and northern pin oak were killed in Douglas County and northern red oaks were killed in Washburn County. A pastured oak woodlot in Polk County suffered nearly complete mortality.

Mortality was also evident in Chippewa, Eau Claire and Jackson counties. Much of this mortality was present on the edges of older oak wilt pockets.

PINE

Drought

The extreme moisture deficit (Figure 8) caused mortality state wide of conifers planted in 1988 and 1987. On sandy soils, mortality was reported at 30 to 50 percent in western Wisconsin. Dry conditions caused some herbicides to be ineffective, therefore leaving weeds to compete with conifer seedlings for moisture.

In northwestern Wisconsin, approximately 50 percent of the conifer seedlings planted in 1988 died. New red pine plantings in Polk County (Sterling Township) and Burnett County (Anderson Township) suffered 80 percent mortality. In southern Douglas County, two- to four-year-old red pine plantations planted in heavy sod had 30 to 50 percent mortality.

Physiological Red Pine Needle Droop - Drought

In 1987, needle droop was common in northwestern Wisconsin in young red pine plantings in Douglas, Bayfield, and Washburn counties. No new locations were detected in northwestern Wisconsin in 1988, but trees affected in 1987 failed to produce new buds in 1988 and will be deformed.

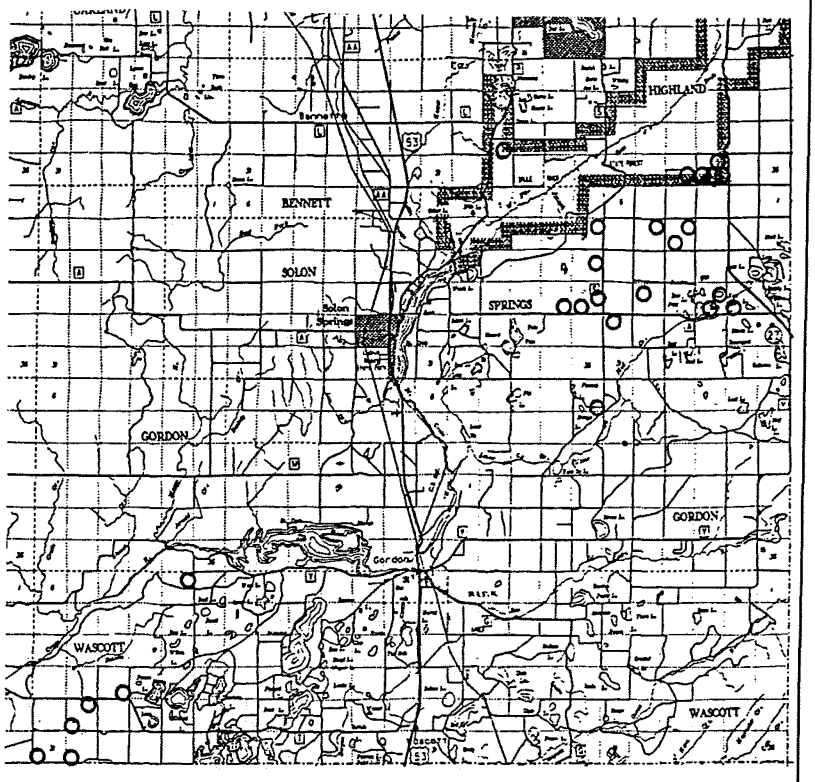


Figure 14. Locations of red pine plantations in Douglas County infected with Diplodia shoot blight and canker.

Diplodia Canker and Shoot Blight - *Sphaeropsis sapinea* (Fr.) Dyke and Sutton

Diplodia shoot blight and canker was widespread in three- to fifteen-year-old red pine plantations in Douglas, northwestern Washburn, northern Burnett, and western Bayfield counties. Incidence of Dipolida was highest in Douglas County (Figure 14). Light green, chlorotic and necrotic branches and tops were first observed in mid-August. Infection incidence within plantations ranged from trace to 15 percent. This is the second time in five years that a high incidence of Diplodia has occurred in northwestern Wisconsin. Branch flagging was common on yard and windbreak trees in Dunn, Pepin, Eau Claire and Jackson counties in western Wisconsin.

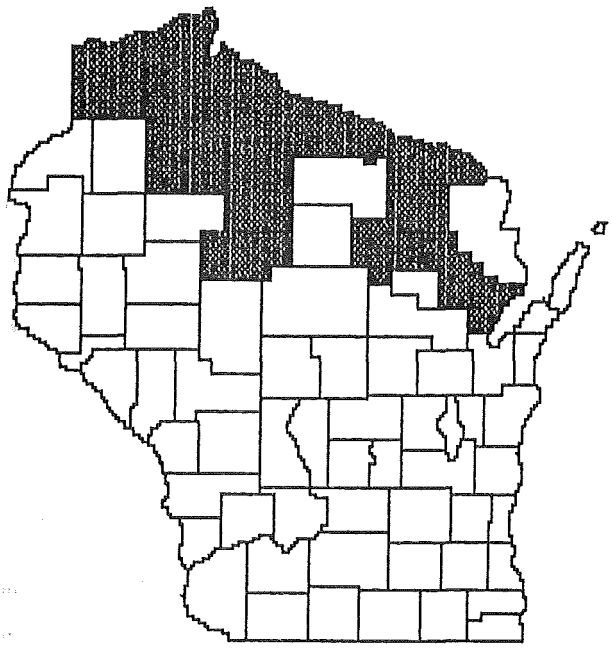


Figure 15. Known county distribution of Scleroderris canker - 1988.

Scleroderris Canker - *Ascocalyx abietina* (Naumov) (Schlaepfer-Bernhard)

Scleroderris canker was present in Bayfield County (SWSW of Section 31, T50N, R5W) but at a reduced incidence from 1987 (Figure 15). This disease was not evident elsewhere.

Red Pine Shoot Blight - *Sirococcus strobilinus* (Pruess)

No new locations were identified of red pine shoot blight in 1988 (Figure 16). New infections within previously infected stands appeared to be low or nonexistent.

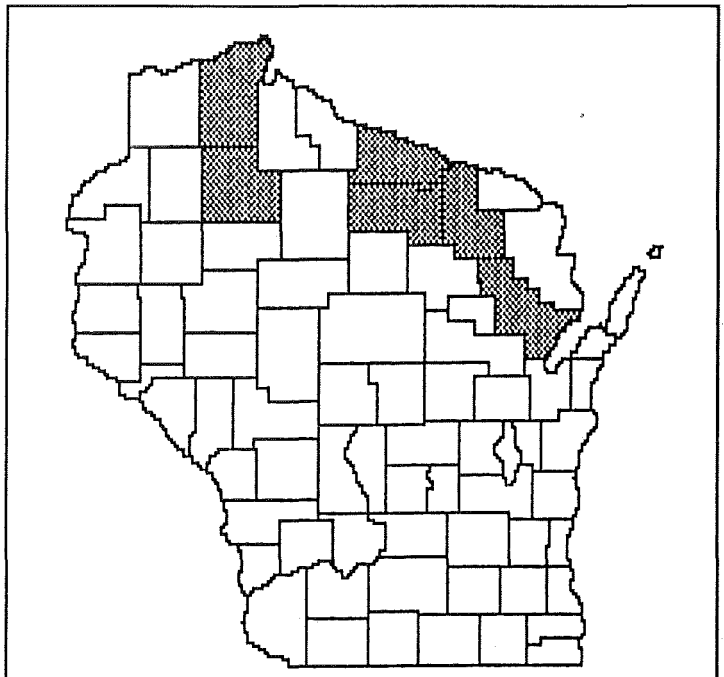


Figure 16. Known county distribution of red pine shoot blight - 1988.

Red Pine Pocket Mortality - Unknown

Ten previously unreported pockets in western Wisconsin were investigated, two in northern LaCrosse County, and eight in Jackson County on the Black River State Forest (Table 3). Two in Dunn County and two in Waukesha County were reported but not investigated (Figure 17).

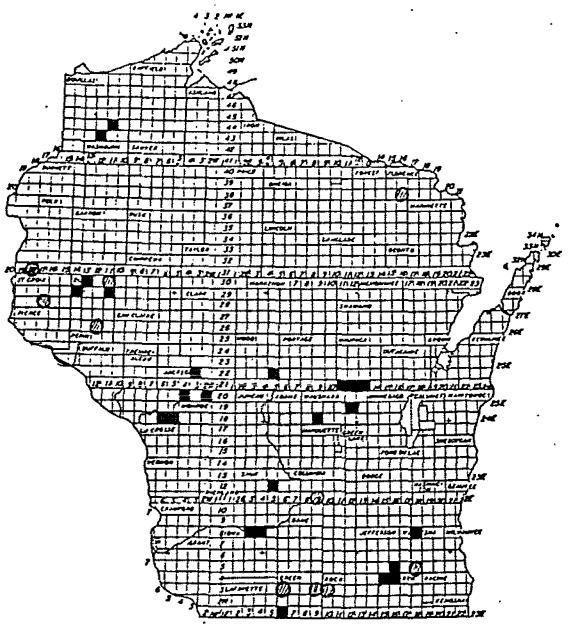


Figure 17. Locations of red pine pocket mortality that have been investigated (square) or reported but not investigated (circle).

Research by Dr. Ken Raffa and Dr. Eugene Smalley at the University of Wisconsin - Madison, continued on the root weevils and fungi associated with red pine pockets. Trenches, forty-eight inches deep, thirty inches wide and forty feet long were dug in four red pine pockets (Jackson, LaCrosse, Sauk and Iowa counties). The trenches were dug so they crossed the boundary of declining and apparently healthy trees. Roots were examined for insect and fungal activity. Trenches were also dug through red pine stands where trees are in an early stage of decline, but no dead trees were present.

Table 3. Locations of red pine decline and mortality investigated in 1988.

COUNTY	LEGAL DESCRIPTION	POCKET DESCRIPTION
LaCrosse	NESec.3,T18N,R6W	Pockets appear to have originated with blow-down damage. Trees have been dying for approximately ten years. Approximately 1.5 acres of trees are dead. Trees are 35-40 years old and have been thinned at least once.
LaCrosse	SESec.12,T18N,R5W	Approximately one acre of scattered dead trees, not in a distinct pocket. Trees are 35-40 years old and have been thinned at least once.
Jackson	SESWSec.32,T20N,R4W	Approximately .5 acre of declining, chlorotic, trees. Height and diameter growth has decreased over the past few years. Trees are 40 years old and have been thinned twice.
Jackson	SESWSec.32,T20N,R4W	Approximately .25 acre of declining chlorotic trees. Same description as previous Jackson County stand.
Jackson	T22N,R3W	Three pockets, all approximately 20-50 trees with declining height and diameter growth and some chlorosis.
Jackson	T21,20N,R2W	Three pockets, all approximately 20-50 trees with declining height and diameter growth and some chlorosis.

Jack Pine Budworm - *Choristoneura pinus* (Rohwer)

A 1270 acre stand of forty-four-year-old jack pine with many openings and wolf trees was heavily defoliated in Vilas County. Populations were low but detectable in Eau Claire and Jackson counties.

No defoliation was observed on old infestation areas in the northwestern counties where egg mass surveys indicate low populations in 1989.

Pine Tussock Moth - *Dasychira pinicola* (Dyar)

Populations continued at very low levels in the old outbreak areas in Douglas and Bayfield counties.

European Pine Sawfly - *Neodiprion sertifer* (Geoffroy)

Populations remained very low. A few colonies were reported on Scotch and red pine in Dane, Green and Waukesha counties.

Phenological note:

May 3 - First hatch from eggs observed in Green County.

Redheaded Pine Sawfly - *Neodiprion lecontei* (Fitch)

Populations are generally very low. A few colonies were observed stripping small, open grown, volunteer jack pine in Burnett and Washburn counties.

Red Pine Needle Midge - *Thecodiplosis piniresinosae* Kearby

The heavy infestation in Burnett and Washburn counties continued with a slight increase in the size of the infestation in Burnett County.

Red Pine Shoot Moth - *Dioryctria resinosella* Mutuura

Heavy numbers of damaged shoots were observed on open grown and edge trees in the western half of Wisconsin. Populations have increase and damaging populations are expected in Jackson, Trempealeau and Monroe counties in 1989.

Eastern Pine Shoot Borer - *Eucosma gloriola* Heinrich

Damage levels were moderate on Scotch pine Christmas trees in Jackson County. Damage was moderate on ten to fifteen foot red pine in Eau Claire, Jackson and Trempealeau counties.

Saratoga Spittlebug - *Aphrophora saratogensis* (Fitch)

A damaging population was discovered in a twenty-five-year-old red pine plantation in Vilas County Forest land. Twenty-nine acres were aerially treated with malathion.

No other damaging populations were observed in Wisconsin.

Pine Root Collar Weevil - *Hylobius radicis* (Buchanan)

Scotch pine mortality generally increased in areas that had previous damage although it may be due to moisture stress and not to increased weevil activity.

One, six-year-old Scotch pine Christmas tree plantation in northern La Crosse County had approximately 5 percent mortality with infestation levels of remaining trees approaching 75 percent.

Pine Root Tip Weevil - *Hylobius rhizophagus* Millers, Benjamin & Warner

A light increase in damage was noted in the northwestern counties; elsewhere damage remained at very low levels.

A small infestation was located on the Black River State Forest in Jackson County with about two acres involved. Mortality to twelve-year-old red pine was evident along the interface between a red pine plantation and natural jack pine stand.

White Pine Weevil - *Pissodes strobi* (Peck)

Increasing numbers of damaged leaders were evident in the southern counties.

Damage was moderate to heavy on open grown white and jack pine in Clark and Jackson counties. Christmas tree growers reported damage to white pine in LaCrosse and Jackson counties and to Scotch pine in eastern Eau Claire County.

Pine Engraver - *Ips pini* (Say)

The severe, extended drought coupled with record high temperatures placed pole sized pines under extreme moisture stress state wide and created ideal conditions for the pine engraver. This bark beetle killed record numbers of pines state wide.

The heaviest damage occurred in the northwestern counties of Polk, Barron, Burnett and Washburn where there have been three hot dry summers in a row. In this area pockets of one hundred dead red pines were common and several stands had pockets of five acres. Some red pine as young as eight years was killed.

Populations exploded over the entire west-central region. Red pine plantations, twenty-five to thirty-five years old, and windbreaks were hardest hit. Jack and white pine were also killed in this area. The hardest hit areas were western St. Croix, southern Dunn, southern Eau Claire, northern Trempealeau, western Jackson, and eastern Monroe counties. Entire one-third to one-half mile windbreaks were destroyed in Dunn, Eau Claire and Pepin counties. Spot kills of fifty to five hundred trees were present.

Heavy mortality occurred on many red and jack pine plantations in Adams, Juneau, Wood and Waupaca counties. In Wood County several plantations were surveyed that suffered 35 to 40 percent mortality.

Red Turpentine Beetle - *Dendroctonus valens* LeConte

The numbers of turpentine beetle attacks increased dramatically from the southwest to the northwest corners of Wisconsin. Scattered individual red and white pines were attacked. Beetles were very common in freshly cut pine stumps and in declining pine in the west central counties.

White Grubs - *Phyllophaga* sp.

Damage to young conifer roots in plantations was very light this year state wide. However, second-year grubs caused heavy balsam fir mortality in a nursery transplant bed in Price County.

Plains Pocket Gopher - *Geomys bursarius*

Damage increased in the west-central and northwestern counties. Damage to Christmas trees was reported in Jackson and Trempealeau counties. A few young red pine plantations in Douglas County suffered 10 percent damage.

Pine Gall Weevil - *Podapion gallicola* Riley

Widespread branch flagging was evident in several red pine plantations in Eau Claire County. Mid-crown branches were affected in stands more that forty years old.

SPRUCE

Yellowheaded Spruce Sawfly - *Pikonema alaskensis* (Rohwer)

Very high populations in Washburn County caused heavy to severe defoliation in some spruce plantings.

RED PINE SEED AND CONE INSECTS

A small test was conducted in the red pine seed orchard near Avoca in Iowa County to learn if *Bacillus thuringiensis* and the insecticide, fenvalerate are effective in preventing insect damage to the seed crop.

B.t. (Dipel 8L) was mixed at a rate of 2 1/2 pints per 100 gal. water. Fenvalerate (Pydrin 2.4EC) was mixed at a rate of 11 fl. oz per 100 gal. water. Five gallons of each mixture were applied per tree to thirty trees. Fenvalerate was applied three times during the spring and summer; B.t. was applied twice. From observation and during harvesting of the cones, it was evident that the B.t. gave some protection from the lepidopterous insects and that the fenvaerate gave more protection. Final results will be published in a future report.

The results of a 1984 test of carbofuran for seed and cone insect control was published in 1987; see: Rush, P.A. et. al. 1987. Carbofuran trials in a red pine seed orchard. Nor. Jour. Appl. For. 4:177-180.

BLACK WALNUT

Walnut Dieback and Canker - Cold and Frost Injury

Five walnut plantations were affected by cold or frost injury in southern Wisconsin in 1988. In Lafayette County, branch tip dieback, top dieback and sprouting on the main stem and at the base was common in two plantations (Section 11, T3N, R3E, and Section 10, T1N, R4E). In one plantation, approximately 85 percent of the trees were affected. The plantations range in age from ten to nineteen years old. In Dane County, approximately 50 percent of the trees in a five acre, ten-year-old plantation had dead tops. The cambium was black on the main stem of affected trees. In Iowa County, dieback of twigs and branches was common on two acres (approximately five hundred trees) of a twenty-year-old plantation (NESW Section 33, T7N, R2E).

Phomopsis was isolated from all four sites from branch and twig cankers.

A plantation in Crawford County (Section 2, T10N, R5W), previously infested with walnut canker caused by *Fusarium sporotrichioides,* had heavy top kill damage due to cold injury. The site is along a stream bottom in a steep narrow valley.

Plantation Black Walnut Canker - *Fusarium sporotrichioides* Sherb.

A survey for the incidence of walnut canker was conducted in three stands in 1985. Between 1985 and 1987, each stand received one of the following treatments: all cankered trees were removed and destroyed, all cankered trees were cut down and left laying in the plantation, or all cankered trees were left standing (no cutting or removal). After treatment, each stand was resurveyed for the incidence of new cankers. Results are listed in Table 2.

Table 2. Incidence of *Fusarium* canker in three black walnut plantations before and after treatment.

Location	Treatment	Canker Incidence (1985)	New Canker Incidence (1987)
Grant County Section 4, T6N, R5W	Cankered trees cut and laid in the plantation.	22%	3%
Grant County Section 24, T6N, R5W	Cankered trees left standing.	33%	6%
Vernon County Section 18, T11N, R5W	Cankered trees cut and destroyed.	32%	0%

The sample of three plantations is too small to draw significant conclusions about the treatments. Certainly the 0.0 percent of new canker incidence is better than 3.0 or 6.0 percent but may not be worth the intense labor effort of cutting and destroying cankered trees in a heavily infected stand. There is not enough information about the epidemiology or potential severity of this disease to predict what may happen to infected stands that are left untreated.

A survey is planned for 1989 to determine the incidence of walnut canker throughout southwestern Wisconsin.

MISCELLANEOUS SPECIES

Gypsy Moth - *Lymantria dispar* (L.)

The number of adult males caught in pheromone traps increased tremendously from seventy-two in 1987 to 599 this year (Figure 18). DNR Forestry personnel cooperated with Wisconsin Department of Agriculture, Trade and Consumer Protection (WDATCP) and USDA-APHIS to conduct egg mass surveys in Marinette, Door, Kewaunee and Waukesha counties. Four egg masses were found in Algoma Township of Kewaunee County. This constitutes the only known current infestation in Wisconsin.

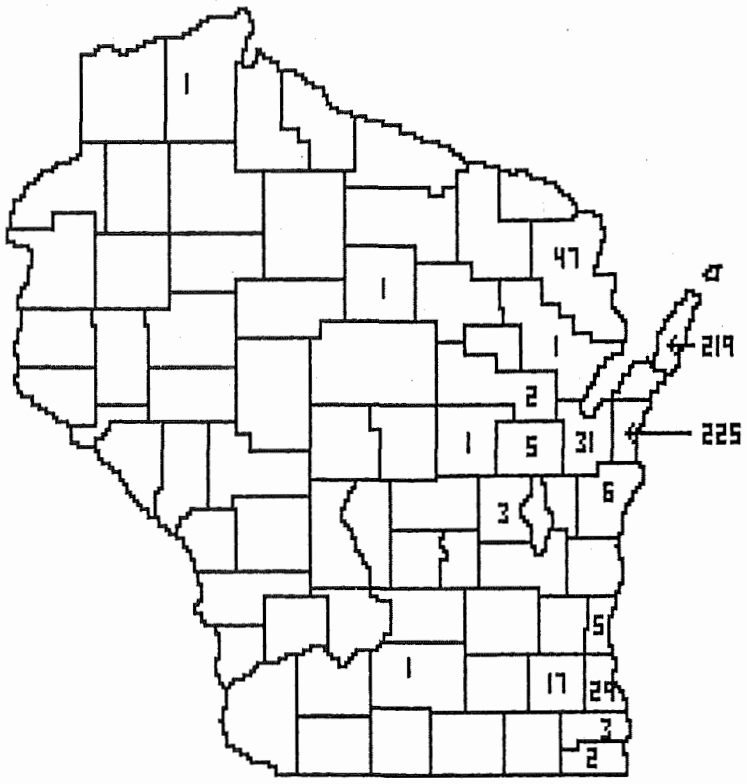


Figure 18. Gypsy moth adult male trap catches - 1988.

Many of the forty-four moths caught in Marinette County probably originated in an infestation on the Michigan side of the Menominee River. It is remotely possible that the large numbers caught in Door and Kewaunee counties may be due to blow-in from heavy infestations in Lower Michigan.

The following table is a summary of information provided by Wisconsin Department of Agriculture.

County	Adult Males	County	Adult Males
Bayfield	1	Oconto	1
Brown	31	Outagamie	5
Door	219	Ozaukee	5
Kenosha	2	Racine	3
Kewaunee	225	Shawano	2
Lincoln	1	Waukesha	17
Manitowoc	6	Waupaca	1
Marinette	47	Winnebago	3
Milwaukee	29	**STATE TOTAL**	599

Hickory Bark Beetle - *Scolytus quadrispinosus* Say

Scattered mortality of both shagbark and bitternut hickory was noted in LaCrosse County. Mortality was often associated with grazing.

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